On a Convenient Method of adjusting a Polar Axis to the Diurnal Motion. By David P. Todd.

[*Communicated by the Secretaries.*]

To eclipse observers often occurs the practical problem of adjusting a polar axis to diurnal motion in the briefest possible time. As a rule their mountings will have no circles, or very small ones; so that the usual method of adjustment either is inapplicable or falls short of the precise alignment desired. Besides this, the finally adjusted axis points in the direction of the true pole, whereas, for best following by clock-motion, it should point toward the apparent or refracted pole, as indicated by Mr. Davidson in his recent paper.

Some years ago, when equipping the U.S. expedition to West Africa for the eclipse of 1889 December 22, I hit upon a method of speedy adjustment which has not, I think, been described heretofore, and which others may find as convenient and expeditious as I have repeatedly since that time. The mechanical requisite is a simple one; the astronomical requisite is that the poleward horizon must be unobstructed—close circumpolars at least must be visible.

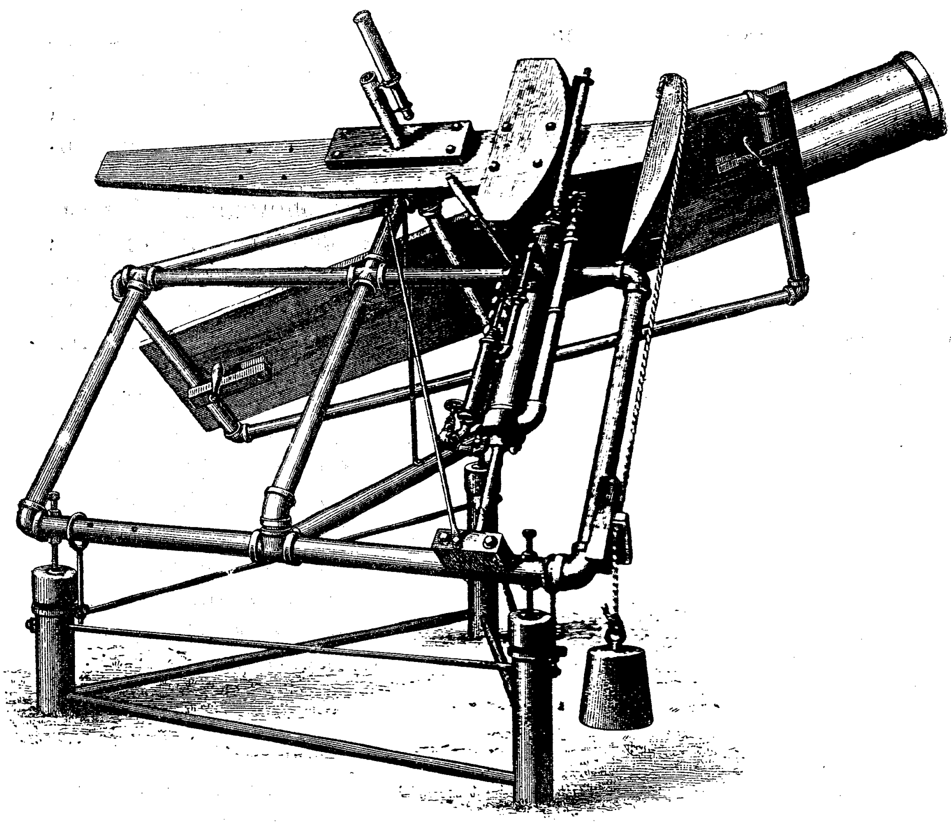
It so happened that this latter precluded actual use of this method on the expedition in question; for, obliged as we were to locate in low south latitudes, proximity of a slight southerly eminence cut off our poleward view. But in the expedition to Japan in 1896—provided by the liberality of Mr. D. Willis James, a trustee, and his son Arthur Curtiss James, a graduate of Amherst College—the method was adapted to three equatorial mountings with perfect success. A lesser one is shown in the accompanying figure.

At the upper or left-hand end of the polar axis is shown a small finder, rigidly attached. The axis of it is adjusted parallel to the mechanical axis of rotation of the polar axis in its bearings. This is easily done by collimating on a well-defined object so distant that twice the space between telescope and polar axis is not a considerable part of distance of object itself.

The finder's large field shows an annular reticle, the ring's angular radius being equal to the polar distance of *Polaris*, if the mounting is to be adjusted in the northern hemisphere. Periphery of the ring is graduated counter-clockwise to twenty-four hours. I found by several trials that graduation to subdivisions of five minutes was fine enough. Preparation of those reticles was troublesome and expensive at first, because done with a dividing engine on glass. At last I found they could be made with high accuracy by photography for a few pence each: carefully draft the circle, graduation, and numerals on Bristol board in very fine lines, and reduce photographically, as if a lantern

transparency. The thinnest of cover glass was used; also the wet collodion process, because it yields a plate almost absolutely transparent.

The finder's focal length must be measured accurately, and the photographic reduction suited thereto. Then adjust the horizontal line of the reticle (18^h–6^h) parallel to the horizontal arm attached to the polar axis. See that this remains level by any convenient means, while the three adjusting screws under the mounting quickly bring *Polaris* into that part of the field



marked by its hour-angle on the graduated circle. A few moments' trial suffices for this adjustment; and verification at sight is always possible whenever the pole star is visible, the only requisite being a knowledge of sidereal time. In some cases a diagonal eyepiece will be an additional convenience. For the southern hemisphere a larger telescope is necessary, but a smaller field will suffice.

After practical use I find this method of adjusting a polar axis most convenient and desirable for expedition work, where disturbance after first adjustment is likely to occur. An accidental thrust in putting an instrument upon the mounting, or some unintentional blow from a rough labourer, may disturb a mounting so that readjustment is necessary. And the means of

constantly testing and quickly remedying this cardinal element of polar alignment is a great comfort as the hour of totality approaches, when a hundred other details crowd for instant attention.

Note on some Results obtained with a Small Prismatic Camera at the Eclipse Camp at Talni. By J. Evershed.

The eclipse work which I undertook in India this year was entirely spectroscopic, and covered practically the same ground as that which I attempted in Norway in 1896. It consisted in obtaining photographs of the spectra of the chromosphere, prominences, and corona.

For this purpose I constructed three photographic instruments: a prismatic camera of $2\frac{1}{4}$ inches aperture and 36 inches focal length, fitted with two 60° prisms; a slit spectrograph, containing two quartz prisms; and a large slitless spectrograph attached to a 6-inch telescope, the latter being mounted on a roughly made equatorial stand.

In addition to these I had available a 4-inch polar heliostat, kindly lent by Mr. Maw, and a $3\frac{1}{4}$-inch equatorial telescope with solar spectroscope attached. The heliostat was used to supply light to the prismatic camera and the slit spectrograph. It was of the ordinary form with two mirrors, but was modified to suit the special work by removing the second mirror and mounting it in the same plane as the first, so that two beams of light were available instead of one beam twice reflected. The tele-spectroscope was used to observe the reversing layer visually, and to determine the right moment to expose the prismatic camera and large slitless spectrograph in order to photograph the "flash" spectrum.

I obtained thirteen photographs in all: one only with the slit spectrograph, which was exposed during the whole time of totality; two with the slitless spectrograph—one at the beginning and one at the end of totality; and a series of ten with the prismatic camera, beginning about 20 seconds before second contact and ending about the same interval after third contact.

The single photograph obtained with the slit spectrograph shows no details of any kind on the very faint continuous spectrum of the corona. The large slitless spectrograph yielded two fairly good negatives, which show a considerable number of bright lines in the region of the spectrum between F and H. The best results were, however, obtained with the prismatic camera. This instrument gave images of the spectrum extending from λ 6000 in the orange to λ 3380 in the ultra-violet. Unfortunately the scale is very small; it is only ·33 inch to the Moon's diameter, and in length 1·52 inches from D to H, the total length of the spectrum photo-